Improvement in Blood Utilization in a General Hospital: The New Role of the Transfusion Review Committee

Presented by
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First, do no harm*

- Don’t transfuse without a medical indication
  - Use only the blood component that is required
  - Use the freshest component available
  - Use only as much of any component as needed
- Minimize allogeneic (‘foreign’) exposure
  - Consider patient’s ability to autologously donate, especially perioperatively**
- Minimize blood draws and sample volume drawn***


### Prevalence of Anemia at Admission Among Various Patient Groups

<table>
<thead>
<tr>
<th>Patient type</th>
<th>Prevalence (%)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rheumatoid arthritis</td>
<td>33-60</td>
<td>Wilson, 2004(^1)</td>
</tr>
<tr>
<td>Surgery</td>
<td>5-75.8</td>
<td>Shander, 2004(^2)</td>
</tr>
<tr>
<td>Cancer</td>
<td>30-90</td>
<td>Knight, 2004(^3)</td>
</tr>
<tr>
<td>HIV</td>
<td>1.3-95</td>
<td>Belperio, 2004(^4)</td>
</tr>
</tbody>
</table>

NEW Role of the “Transfusion Review” or “Blood Utilization” Committee

- Promote preventive strategies to reduce inappropriate transfusions
  - Establish 30-day pre-operative evaluation for elective surgery patients
    - “Anemia” clinics → one model
  - Establish guidelines for use of pharmacologic measures to improve hemoglobin levels pre-operatively
  - Evaluate all medications (including herbals) and, if possible, reduce or eliminate those that affect coagulation
Preoperative Autologous Blood Donation (PABD)*

- Superior only in patients in whom the hematocrit at the time of the PABD was less than the hematocrit at the time of surgery.

- Most effective under the following two conditions:
  1. Hematocrit is between 35 and 40% at the time of surgery
  2. At least 4 weeks elapse between the last PABD collection and surgery.

Does Age Matter?

Scanning electron micrographs of red blood cells isolated from stored blood on Day 1, Day 21, and Day 35. During storage, the shape of RBCs changed gradually from normal discoid to echinocytes (dented or shriveled red cells).

Table 2. Univariate analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Donors</th>
<th>Nondonors</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean duration of surgery (minutes)</td>
<td>191</td>
<td>193</td>
<td>0.95</td>
</tr>
<tr>
<td>Mean number comorbidities</td>
<td>1.54</td>
<td>1.27</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Mean number of levels operated</td>
<td>2.0</td>
<td>2.3</td>
<td>0.07</td>
</tr>
<tr>
<td>Mean blood loss (cc)</td>
<td>963</td>
<td>796</td>
<td>0.16</td>
</tr>
<tr>
<td>Mean blood replacement (cc)</td>
<td>1391</td>
<td>410</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Mean preoperative hemoglobin (g/dL)</td>
<td>11.7</td>
<td>13.2</td>
<td>0.04</td>
</tr>
<tr>
<td>Mean postoperative hemoglobin (g/dL)</td>
<td>11.3</td>
<td>10.9</td>
<td>0.40</td>
</tr>
<tr>
<td>Mean age (years)</td>
<td>61.4</td>
<td>61.3</td>
<td>0.86</td>
</tr>
<tr>
<td>Mean BMI (kg/m2)</td>
<td>25.9</td>
<td>23.6</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Allogeneic Transfusion after Predonation of Blood for Elective Spine Surgery
Kathleen F. Brookfield PhD, MPH, Mark D. Brown MD, PhD, Steven M. Henriques BA, Frank A. uttacavoli BA, Alison P. Seitz
“NEW” Role – (2)

- Benchmark current transfusion practices
  - Establish clinical and laboratory thresholds
    - Use EMR whenever possible
    - Rely on current literature for evidence-based practices
  - Measure patient outcomes
  - Educate clinicians
Variability in Intraoperative Transfusions for Cardiac Surgery*

*Estimated to consume 20% of all RBCs transfused/year

Fig. 1. Frequency and amount of intraoperative homologous and autologous RBC (A), FFP (B), and PLT (C) transfusion. Percentage transfused and mean number of units per transfused patient (number above columns) for each country and overall total (all 5065 study patients). T = Thailand; M = Mexico; P = Poland; IND = India; A = Austria; R = Romania; G = Germany; US = United States; IS = Israel; N = Netherlands; CO = Colombia; I = Italy; UK = United Kingdom; H = Hungary; CA = Canada; F = France (order based on decreasing number of study centers per country). RBCs = RBCs and/or whole blood.
Anemia: Lower the Transfusion Trigger Point?

- Hb 7.0 g/dL-9.0 g/dL sufficient in critically ill patients

- Much lower Hb tolerated (>5.0 g/dL) in nonstressed normal patients

- Patients with CAD may require Hb levels in slightly higher ranges (8.0 g/dL-9.0 g/dL) and avoid tachycardia
  - β-blockers
  - Euvolemia

- Minimum, safe (optimal) Hb/Hct unknown
“NEW” Role – (3)

- Create and disseminate educational materials about transfusion – for both patients and physicians
  - Obtain ‘expert’ information
    - Reasons for transfusion
    - Risks/benefits
    - Alternatives (and their risks/benefits)
  - Monitor availability
  - Audit use of these materials for the informed consent discussion
  - Review frequently for currency of information
“NEW” role – (4)

- Perioperative interventions
  - Establish guidelines for use of peri-operative cell-saving/reinfusion activities
  - Credential operators
  - Monitor quality of collections
  - Audit appropriateness of use
  - Measure patient outcomes
What Is Patient Blood Management?

- Blood management is the appropriate provision and use of blood, its components and derivatives, and strategies to reduce or avoid the need for a blood transfusion.
The Pillars of Patient Blood Management

- Optimizing the hemoglobin level by recognizing, detecting, and treating anemia in all clinical situations
- Anticipating and managing possible hemostatic difficulties
- Having a consistent approach to blood conservation
- Using blood transfusions appropriately
Efficacy of blood

For many years, focus has been on the safety of blood

The other half of the equation – efficacy – has been largely ignored

- Initially, transfusions gained huge success in saving patients who used to bleed to death with limited resuscitation options available (e.g. WW2 casualties) → “gift of life”
- Use of blood continued and grew to this age in several other scenarios:
  - Vast majority of transfusions are given to hemodynamically stable, non-bleeding patients → Prophylactic transfusion

Benefits of blood in most patients who are routinely transfused nowadays are not established
Why PBM?

Many risks, few or no benefits – The net results?

Accumulating evidence shows that blood transfusions do not improve patients’ outcomes, and in many cases, result in worse outcomes:

- Higher mortality
- Higher morbidity
- Longer hospital/ICU stay and more
Does RBC age matter?

**Figure 3. Kaplan–Meier Estimates of Survival and Death.**
The curves show data from 2872 patients who were given exclusively newer blood (stored for 14 days or less) and 3130 patients given exclusively older blood (stored for more than 14 days). The numbers above and below the curves represent the numbers of patients who were alive and under follow-up observation in each group at that time. The solid lines of the same color represent estimated survival or the rate of death, and the dotted lines represent pointwise 95% confidence intervals. The nonparametric survival estimator (orange squares or blue circles), as determined by the Kaplan–Meier method, is superimposed on the parametric survival function estimator. In this unadjusted comparison, the percentage of patients receiving older blood who survived was lower than the percentage of those receiving newer blood who survived, especially during the initial follow-up period.

Colleen Gorman Koch, M.D., Liang Li, Ph.D., Daniel I. Sessler, M.D., Priscilla Figueroa, M.D., Gerald A. Hoeltge, M.D., Tomislav Mihaljevic, M.D., and Eugene H. Blackstone, M.D.

Duration of Red-Cell Storage and Complications after Cardiac Surgery
Why PBM?

- Drawback: The evidence is mostly from uncontrolled cohort studies
  - Are the patients sick because they are transfused? or...
  - Are they transfused, because they are sick?
Why PBM?

- Other issues:
  - Changing population dynamics: Less potential donors and more potential recipients down the way
  - Cost of blood
  - Logistics of blood
  - [Availability (national/local/seasonal)]

2050 Projection
Cost of Blood
AABB data suggest that the number of transfusions per 1000 US population is stable/slightly declining.

AHRQ data suggest that the number of transfusions per 1000 hospital stays with a procedure is rapidly rising.
Role of Medical Staff in Patient Blood Management

- Obtain institution-specific information about current transfusion practices
- Establish requirement for prospective evaluation of all patients who may need transfusion
  - Check for anemia; treat, if necessary
  - Check for bleeding/clotting problems
  - Evaluate all current medications for possible adverse effects related to bleeding/clotting
- Determine and follow patient’s wishes regarding transfusion
Establish criteria for use of perioperative blood conservation measures and audit periodically for patient outcomes.

Revise frequency and volume of blood taken for laboratory testing.

Revisit transfusion guidelines in light of new information:

- Perform prospective audits of requests to transfuse by type of blood component.

Distribute report cards to ordering physicians.
Evaluating a Patient for Possible Transfusion

- What’s the patient’s current medical condition?
  - Bleeding/clotting history
  - Simple laboratory assessments for
    - Anemia?
    - Any potential bleeding/clotting problems?
  - Current medications
- Explore blood management options
  - Cell saving/reinfusion or ANH
- Pharmacologic interventions
- Timing of procedure
Strategies for Reducing Blood Loss During Surgery

- Careful surgical dissection and hemostasis
- Use of controlled hypotensive anesthesia\(^1\)
- Maintenance of normothermia\(^1\)
- Blood cell salvage\(^1\)
- Tolerance of normovolemic anemia\(^1\)
- Elevating the surgical site\(^2\)

Can PBM Beat the Trend?

- PBM and its components in action:
  - EHMC experience
  - Northern New England Cardiovascular Disease Study Group (NNECDSG) experience
  - Rhode Island Hospital experience
  - Providence Regional Medical Center Everett (PRMCE) experience
  - Ontario Hospitals experience
  - Virginia Commonwealth University experience
PBM in Practice – EHMC

- EHMC experience – A multimodality, multidisciplinary approach

Since 1993, number of RBC units transfused per “at risk” surgical patient has steadily declined.

Transfusion rate in CABG
- EHMC: Around 10%

Despite low transfusion rates at EHMC, mortality and perioperative adverse events matched for illness severity were unaffected.

Shander & Goodnough. Curr Opin Hematol. 2006
Using the blood component prescription form, audit every order for blood components versus the clinical situation.

The following two clinical situations were targeted:

- Patients with mildly elevated INRs (<2) FFP with WHO grade I or II bleeding or prior to an invasive procedure (Advice: No prophylactic plasma; only give FFP if bleeding occurs or bleeding grade aggravates).

- Patients with higher INRs (3 - 16) on warfarin when there is WHO Grade I or II bleeding or if an invasive procedure is planned (Advice: No prophylactic plasma; use VitK).
RIH - Altering Txn Practice

85% reduction in FFP over 7 years

Courtesy of Dr. Joseph Sweeney
During the same period, discharges remained unchanged and patient acuity slightly increased.
Note: Data for pre, intra and postop RBC units must be available to calculate total units.
Trend in RBC Txn by Gender

WOMEN

- PRH
- CMMC
- DHMC
- FAHC
- MMC
- CMC
- EMMC
- CH

Note: Data for pre, intra and postop RBC units must be available to calculate total units.

MEN

- PRH
- CMMC
- DHMC
- FAHC
- MMC
- CMC
- EMMC
- CH

Note: Data for pre, intra and postop RBC units must be available to calculate total units.

Courtesy of Dr. Irwin Gross
Limited outcome data related to transfusion currently available (from Eastern Maine Medical Center):

- Decrease in LOS
- Decrease in infectious complications
- Trend toward less new onset ARF
- Mortality unchanged

Courtesy of Dr. Irwin Gross
A multidisciplinary approach to reducing RBC transfusion in cardiac surgery

- Trend of RBC units transfused per recipient by year

Brevig J et al. ATS. 2009
Incidence of RBC txn over time
Outcome data

While the RBC utilization fell from 38% to 14%:

- The isolated CABG morbidity remained stable or improved
- New renal insufficiency decreased from 2.1% to 1.1%
- Median postoperative length of stay declined from 4 to 3 days
- Postoperative intubation duration fell to 3 hours from the original 4.5 hours

In 2007, there was an increase in CABG mortality rates. Analysis showed that this rise was confined to those patients who received RBCs

Brevig J et al. ATS. 2009
Ontario Txn Coordinators (ONTraC)

- Blood conservation coordinators were placed in 23 Ontario hospitals
- Focus on 3 designated procedures:
  - Knee arthroplasty
  - AAA
  - CABG
- PBM measures: education, PAD, ESA, cell salvage
Time periods:
- 1: Baseline
- 2: 12 mo
- 3: 18 mo
- 4: 24 mo

Freedman J et al. Transfusion. 2008
Transfusion reduction at 12 months:
- 24% reduction in knee surgery
- 14% reduction in AAA
- 23% reduction in CABG

Patients who were transfused received less allogeneic blood.

Outcome findings:
- Patients who did not receive allogeneic transfusions had lower postoperative infection rates ($p < 0.05$) and length of stay ($p < 0.0001$)
- Allogeneic transfusion was an independent predictor of increased length of stay.
A comprehensive education program in cardiac surgery

- All transfusions limited to “appropriate” clinical indications, such as evidence of oxygen-delivery debt, rather than any single triggers.

Following implementation of the guidelines:

- RBC transfusion reduced from 42% to 13%
- Mean # of transfused units dropped from 4.8 to 3.1 units/patient
EHMC (cardiac surgery):
- From 1.2 to 0.6 RBC units/pt
- RBC transfusion rate 10% (vs. 27-92% elsewhere)

RI Hospital (General):
- 85% reduction in FFP usage
- 16% reduction in RBC usage

PRMCE (cardiac surgery):
- RBC transfusion rate fell from 38% to 14%

ONTraC (CABG/AAA/Knee):
- 13-24% reduction in transfusion rate

VCU (cardiac surgery)
- RBC transfusion reduced from 42% to 13%

In all cases, outcomes were unchanged or improved
Current nation-wide trends suggest increasing transfusion rates among hospitalized patients undergoing procedures, although per-general-population rates appear to be stable.

PBM is effective in reducing transfusion utilization while maintaining (or improving) patient outcomes.

Responsible medical staffs can improve patient outcomes by appropriate implementation of PBM.
Develop prospective strategies
  - Anemia clinics
  - Hemostasis evaluations
Establish policies that prevent or minimize inappropriate use of allogeneic AND autologous blood
Develop guidelines for perioperative blood conservation measures and audit these practices
Reduce frequency and volume of blood draws for laboratory testing
FOCUS on PATIENT OUTCOMES